

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: David J. Roach et al.

PATENT APPLICATION

Serial No.: 09/556,897

Group Art Unit: 1743

Filed: April 20, 2000

Examiner: P.K. Bex

For: ROBOTIC MICROCHANNEL BIOANALYTICAL INSTRUMENT

MARKED-UP CLAIMS

1. (currently amended) A robotic instrument for microchannel chemical analysis of samples in microchannels on a microchip substrate, the substrate having a plurality of microchannels therein with inlet ports in fluid communication with the microchannels, the instrument comprising:

a first frame,

a first track having the first frame movably mounted thereon,

a second frame for holding a microtiter plate, said plate having a plurality of spaced apart wells whose positions are known,

a second track having the second frame movably mounted thereon,

a gantry spanning the first and second tracks at an elevation above the tracks, the gantry carrying a multifunctional device including a plurality of ganged pipettors and a vacuum line, the multifunctional device being horizontally movable on the gantry and vertically movable from the gantry towards and away from the first track and the second track such that said multifunctional device may be aligned to transfer liquid from a plurality of wells on the plate to a plurality of inlet ports on the substrate, and

a plurality of motors arranged to provide motive power to the multifunctional device, the first frame, and the second frame; and

a substrate gripper movable to the first frame from other locations.

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2. (currently amended) The apparatus of claim 1 further ~~defined by a substrate gripper movable to the first frame from other locations, the gripper having~~ including a motor controlling vertical and horizontal motion of the gripper.

3. (previously presented) The robotic instrument of claim 1 further comprising a plurality of electrode wires mounted on a platform above the first track that are insertable into inlet ports of the substrate.

4. (original) The robotic instrument of claim 3 further comprising a circuit board mounted to said platform wherein said electrode wires extend perpendicularly from said circuit board of said platform.

5. (original) The robotic instrument of claim 4 wherein said circuit board has:

a first electrode terminal in electrical communication with a first wire trace and sample terminals of said microchip substrate,

a second electrode terminal in electrical communication with a second wire trace and cathode terminals of said microchip substrate,

a third electrode terminal in electrical communication with a third wire trace and waste terminals of said microchip substrate, and

a fourth electrode terminal in electrical communication with a fourth wire trace and an anode terminal of said microchip substrate.

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6. (original) The apparatus of claim 5 further comprising a fifth electrode terminal in electrical communication with a fifth wire trace and a second set of sample terminals of said microchip substrate.

7. (original) The robotic instrument of claim 1 further comprising a detector located on a platform above the first track.

8. (original) The robotic instrument of claim 7 wherein said detector includes a scanning confocal laser microscope.

9. (original) The robotic instrument of claim 1 further comprising a platform above the first track, said platform having a detector and a plurality of wires located on it.

10. (canceled)

11. (currently amended) The robotic instrument of claim 1 [[10]] wherein said plurality of pipettors have a spacing between each pipettor that matches the spacing between each of the wells of said spaced apart wells.

12. (currently amended) The robotic instrument of claim 1 [[10]] further comprising a tip guide wherein said plurality of pipettors have tips that are inserted through said tip guide.

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13. (currently amended) The robotic instrument of claim 1
[[10]] further comprising a pipettor assembly actuator.

14. (original) The apparatus of claim 3 further comprising an
electrode wire wash station on said first frame.

15. (original) The apparatus of claim 1 further comprising
optical and mechanical position sensors located on said first
and second frames.

16-30.. (canceled)

31. (new) A robotic instrument for microchannel chemical
analysis of samples in microchannels on a microchip substrate,
the substrate having a plurality of microchannels therein with
inlet ports in fluid communication with the microchannels, the
instrument comprising:

a first frame,

a first track having the first frame movably mounted
thereon,

a second frame for holding a microtiter plate, said
plate having a plurality of spaced apart wells whose positions
are known,

a second track having the second frame movably
mounted thereon,

a gantry spanning the first and second tracks at an
elevation above the tracks, the gantry carrying a
multifunctional device including a plurality of ganged
pipettors and a vacuum line, the multifunctional device being
horizontally movable on the gantry and vertically movable from
the gantry towards and away from the first track and the

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second track such that said multifunctional device may be aligned to transfer liquid from a plurality of wells on the plate to a plurality of inlet ports on the substrate,

a plurality of motors arranged to provide motive power to the multifunctional device, the first frame, and the second frame; and

a plurality of electrode wires mounted on a platform above the first track that are insertable into inlet ports on the substrate.

32. (new) The apparatus of claim 31 further defined by a substrate gripper movable to the first frame from other locations, the gripper having a motor controlling vertical and horizontal motion.

33. (new) The robotic instrument of claim 32 further comprising a circuit board mounted to said platform wherein said electrode wires extend perpendicularly from said circuit board of said platform.

34. (new) The robotic instrument of claim 33 wherein said circuit board has:

a first electrode terminal in electrical communication with a first wire trace and sample terminals of said microchip substrate,

a second electrode terminal in electrical communication with a second wire trace and cathode terminals of said microchip substrate,

a third electrode terminal in electrical communication with a third wire trace and waste terminals of said microchip substrate, and

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a fourth electrode terminal in electrical communication with a fourth wire trace and an anode terminal of said microchip substrate.

35. (new) The apparatus of claim 34 further comprising a fifth electrode terminal in electrical communication with a fifth wire trace and a second set of sample terminals of said microchip substrate.

36. (new) The robotic instrument of claim 31 further comprising a detector located on said platform above the first track.

37. (new) The robotic instrument of claim 36 wherein said detector includes a scanning confocal laser microscope.

38. (new) The robotic instrument of claim 31 wherein said plurality of pipettors have a spacing between each pipettor that matches the spacing between each of the wells of said spaced apart wells.

39. (new) The robotic instrument of claim 31 further comprising a tip guide wherein said plurality of pipettors have tips that are inserted through said tip guide.

40. (new) The robotic instrument of claim 31 further comprising a pipettor assembly actuator.

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41. (new) The apparatus of claim 31 further comprising an electrode wire wash station on said first frame.

42. (new) The apparatus of claim 31 further comprising optical and mechanical position sensors located on said first and second frames.

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For: ROBOTIC MICROCHANNEL BIOANALYTICAL INSTRUMENT

CLEAN CLAIMS

1. A robotic instrument for microchannel chemical analysis of samples in microchannels on a microchip substrate, the substrate having a plurality of microchannels therein with inlet ports in fluid communication with the microchannels, the instrument comprising:

a first frame,

a first track having the first frame movably mounted thereon,

a second frame for holding a microtiter plate, said plate having a plurality of spaced apart wells whose positions are known,

a second track having the second frame movably mounted thereon,

a gantry spanning the first and second tracks at an elevation above the tracks, the gantry carrying a multifunctional device including a plurality of ganged pipettors and a vacuum line, the multifunctional device being horizontally movable on the gantry and vertically movable from the gantry towards and away from the first track and the second track such that said multifunctional device may be aligned to transfer liquid from a plurality of wells on the plate to a plurality of inlet ports on the substrate,

a plurality of motors arranged to provide motive power to the multifunctional device, the first frame, and the second frame; and

a substrate gripper movable to the first frame from other locations.

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2. The apparatus of claim 1 further including a motor controlling vertical and horizontal motion of the gripper.

3. The robotic instrument of claim 1 further comprising a plurality of electrode wires mounted on a platform above the first track that are insertable into inlet ports of the substrate.

4. The robotic instrument of claim 3 further comprising a circuit board mounted to said platform wherein said electrode wires extend perpendicularly from said circuit board of said platform.

5. The robotic instrument of claim 4 wherein said circuit board has:

 a first electrode terminal in electrical communication with a first wire trace and sample terminals of said microchip substrate,

 a second electrode terminal in electrical communication with a second wire trace and cathode terminals of said microchip substrate,

 a third electrode terminal in electrical communication with a third wire trace and waste terminals of said microchip substrate, and

 a fourth electrode terminal in electrical communication with a fourth wire trace and an anode terminal of said microchip substrate.

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6. The apparatus of claim 5 further comprising a fifth electrode terminal in electrical communication with a fifth wire trace and a second set of sample terminals of said microchip substrate.

7. The robotic instrument of claim 1 further comprising a detector located on a platform above the first track.

8. The robotic instrument of claim 7 wherein said detector includes a scanning confocal laser microscope.

9. The robotic instrument of claim 1 further comprising a platform above the first track, said platform having a detector and a plurality of wires located on it.

10. (canceled)

11. The robotic instrument of claim 1 wherein said plurality of pipettors have a spacing between each pipettor that matches the spacing between each of the wells of said spaced apart wells.

12. The robotic instrument of claim 1 further comprising a tip guide wherein said plurality of pipettors have tips that are inserted through said tip guide.

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13. The robotic instrument of claim 1 further comprising a pipettor assembly actuator.

14. The apparatus of claim 3 further comprising an electrode wire wash station on said first frame.

15. The apparatus of claim 1 further comprising optical and mechanical position sensors located on said first and second frames.

16-30. (canceled)

31. A robotic instrument for microchannel chemical analysis of samples in microchannels on a microchip substrate, the substrate having a plurality of microchannels therein with inlet ports in fluid communication with the microchannels, the instrument comprising:

a first frame,

a first track having the first frame movably mounted thereon,

a second frame for holding a microtiter plate, said plate having a plurality of spaced apart wells whose positions are known,

a second track having the second frame movably mounted thereon,

a gantry spanning the first and second tracks at an elevation above the tracks, the gantry carrying a multifunctional device including a plurality of ganged pipettors and a vacuum line, the multifunctional device being horizontally movable on the gantry and vertically movable from the gantry towards and away from the first track and the

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second track such that said multifunctional device may be aligned to transfer liquid from a plurality of wells on the plate to a plurality of inlet ports on the substrate,

a plurality of motors arranged to provide motive power to the multifunctional device, the first frame, and the second frame; and

a plurality of electrode wires mounted on a platform above the first track that are insertable into inlet ports on the substrate.

32. The apparatus of claim 31 further defined by a substrate gripper movable to the first frame from other locations, the gripper having a motor controlling vertical and horizontal motion.

33. The robotic instrument of claim 32 further comprising a circuit board mounted to said platform wherein said electrode wires extend perpendicularly from said circuit board of said platform.

34. The robotic instrument of claim 33 wherein said circuit board has:

a first electrode terminal in electrical communication with a first wire trace and sample terminals of said microchip substrate,

a second electrode terminal in electrical communication with a second wire trace and cathode terminals of said microchip substrate,

a third electrode terminal in electrical communication with a third wire trace and waste terminals of said microchip substrate, and

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a fourth electrode terminal in electrical communication with a fourth wire trace and an anode terminal of said microchip substrate.

35. The apparatus of claim 34 further comprising a fifth electrode terminal in electrical communication with a fifth wire trace and a second set of sample terminals of said microchip substrate.

36. The robotic instrument of claim 31 further comprising a detector located on said platform above the first track.

37. The robotic instrument of claim 36 wherein said detector includes a scanning confocal laser microscope.

38. The robotic instrument of claim 31 wherein said plurality of pipettors have a spacing between each pipettor that matches the spacing between each of the wells of said spaced apart wells.

39. The robotic instrument of claim 31 further comprising a tip guide wherein said plurality of pipettors have tips that are inserted through said tip guide.

40. The robotic instrument of claim 31 further comprising a pipettor assembly actuator.

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41. The apparatus of claim 31 further comprising an electrode wire wash station on said first frame.

42. The apparatus of claim 31 further comprising optical and mechanical position sensors located on said first and second frames.